Stoller
Grand Junction Office established 1959

299-E25-20 (A4767)
Log Data Report

Borehole Information:

Borehole: 299-E25-20 (A4767)			**Site:** 216-A-37-1 Crib		
Coordinates (WA State Plane)		**GWL (ft)[1]:** 278.8		**GWL Date:**	3/18/2003
North	**East**	**Drill Date**	**TOC[2] Elevation**	**Total Depth (ft)**	**Type**
135,654 m	575,910.94 m	July 1976	207.206 m	294	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	0	unknown	8	unknown		151.7
Welded steel	1.7	6 5/8	6	0.3125	+1.7	301.7
The logging engineer measured the 6-in. casing stick up using a steel tape. A caliper was used to determine the outside casing diameter. The caliper and inside casing diameter were measured using a steel tape. Measurements were rounded to the nearest 1/16 in. The 6-in. casing thickness was calculated. There was no evidence of 8-in. casing at the ground surface as reported in Ledgerwood (1993). Surrounding the borehole stick-up is an 18-in. by 4-in. high surface seal of grout.						

Borehole Notes:

Borehole coordinates, elevation, and well construction information are from measurements by Stoller field personnel, HWIS[3], and Ledgerwood (1993). Zero reference is the top of the 6-in. casing. A reference point survey "X" is located at the top of the casing stickup.

Logging Equipment Information:

Logging System:	Gamma 2B		**Type:** 35% HPGe
Calibration Date:	01/2003	**Calibration Reference:**	GJO-2003-418-TAC
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3/Repeat	4	5
Date	3/17/03	3/18/03	3/18/03	3/18/03	3/19/03
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	75.0	292.0	180.0	151.0	146.0
Finish Depth (ft)	2.0	148.0	151.0	145.0	74.0
Count Time (sec)	200	100	100	200	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
ft/min	N/A[4]	N/A	N/A	N/A	N/A
Pre-Verification	BB165CAB	BB166CAB	BB166CAB	BB166CAB	BB167CAB

Log Run	1	2	3/Repeat	4	5
Start File	BB165000	BB166000	BB166145	BB166175	BB167000
Finish File	BB165073	BB166144	BB166174	BB166181	BB167072
Post-Verification	BB165CAA	BB166CAA	BB166CAA	BB166CAA	BB167CAA
Depth Return Error (in.)	+1	N/A	N/A	0	0
Comments	No fine-gain adjustment.	Fine-gain adjustment after files -002, -007, -012, and -027.	Fine-gain adjustment after file -157.	No fine-gain adjustment.	Fine-gain adjustment after file -032.

Logging Operation Notes:

Zero reference was top of the 6-in. casing. Logging was performed with the centralizer on the sonde. A count time of 200 sec was used in the double cased portion of the borehole. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 082. During SGLS logging, fine-gain adjustments were needed to maintain the 1460-keV (^{40}K) photopeak at a pre-described channel.

Analysis Notes:

Analyst:	Sobczyk	Date:	03/26/03	Reference:	GJO-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day and compared to control limits established on 12/05/2002. The verification spectra were all above the upper control limit for the 609-keV full-width at half-maximum value. The verification spectra were all above the upper control limit for the 1461-keV full-width at half-maximum value except for BB166CAA. Post-run verification spectrum BB166CAA was below the control limits for the 1461-keV peak and 2615 peak counts per second. The peak counts per second at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were between 5 and 14 percent lower at the end of the day. Examinations of spectra indicate that the detector functioned normally during all of the logging runs, and the spectra are accepted.

Log spectra for the SGLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Post-run verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G2Bfeb03.xls), using parameters determined from analysis of recent calibration data. Zero reference was the top of the 6-in. casing. On the basis of information reported in Ledgerwood (1993), the casing configuration was assumed to be one string of 6-in. casing to total log depth (292 ft) and one string of 8-in. casing to 151.7 ft. Casing correction factors were calculated assuming a total casing thickness of 0.635 in. from 0 to 151.7 ft, and 0.3125 in. from 151.7 to 285 ft. The casing correction factor was calculated assuming a 6-in. casing thickness of 0.3125 in. and an 8-in. casing thickness of 0.322 in. The 6-in. casing thickness is based upon the field measurement, and the 8-in. casing thickness of 0.322 in. is the published values for ASTM schedule-40 steel pipe (commonly used casing material at Hanford). Where more than one casing exists at a depth, the casing correction is additive (e.g., 0.322 in. + 0.3125 in. = 0.635 in. would be the combined thickness for the 6-in. and 8-in. casings). A water correction was applied to the data below 278.8 ft. Dead time corrections were not applied because dead time was not greater than 10.5 percent.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless

otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it is less affected by the presence of radon gas inside the casing.

Results and Interpretations:

^{137}Cs was the only man-made radionuclide detected in this borehole. ^{137}Cs was detected at log depths of 19, 22, 29, 58, 116, 168, and 270 ft with concentrations near the MDL (0.2 pCi/g). After examination of the spectra, it was determined that there is no evidence of a photopeak at 662 keV. The reported peaks are probably the result of statistical fluctuation.

Recognizable changes in the KUT logs occurred in this borehole. However, the changes above 152 ft are probably more indicative of the well completion materials than the surrounding formation. The annulus between the 6-in. and 8-in. casings was perforated between 22 and 152 ft and grouted with cement.

The behavior of the ^{238}U log suggests that radon may be present inside the borehole casing. Determination of ^{238}U is based on measurement of gamma activity at 609 and/or 1764 keV associated with ^{214}Bi, under the assumption of secular equilibrium in the decay chain. However, ^{214}Bi is also a short-term daughter of ^{222}Rn. When radon is present, ^{214}Bi will tend to "plate" onto the casing wall and will quickly reach equilibrium with ^{222}Rn. Because the additional ^{214}Bi resulting from radon is on the inside of the casing, the effect of the casing correction is to amplify the 609 photopeak relative to the 1764 photopeak. (The magnitude of the casing correction factor decreases with increasing energy, but gamma rays originating inside the casing are not attenuated.) This effect is observed in log run 5 (146 ft to 74 ft). The effects of radon appear to be minimal during the first four log runs. The reason for variations in radon content between log runs on successive days is not known. Variations in radon content in boreholes are probably related to variations in surface weather conditions. Radon daughters such as ^{214}Bi may also "plate" onto the sonde itself. When this occurs, there is a gradual increase in total counts as well as photopeak counts associated with ^{214}Bi and ^{214}Pb. This phenomenon appears to best explain the observed discrepancy in ^{238}U values based on 609 keV versus those based on 1764 keV during log run 5 (146 ft to 74 ft).

The presence of radon is not an indication of man-made contamination: it is derived from decay of naturally occurring uranium. As a gas, radon moves easily in the subsurface, and concentrations of radon and its associated progeny can change quickly. The effects of radon on borehole logging are described in GJO-HGLP 1.6.3, Rev. 0 (2003).

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural radionuclides (609, 1461, 1764, and 2614 keV).

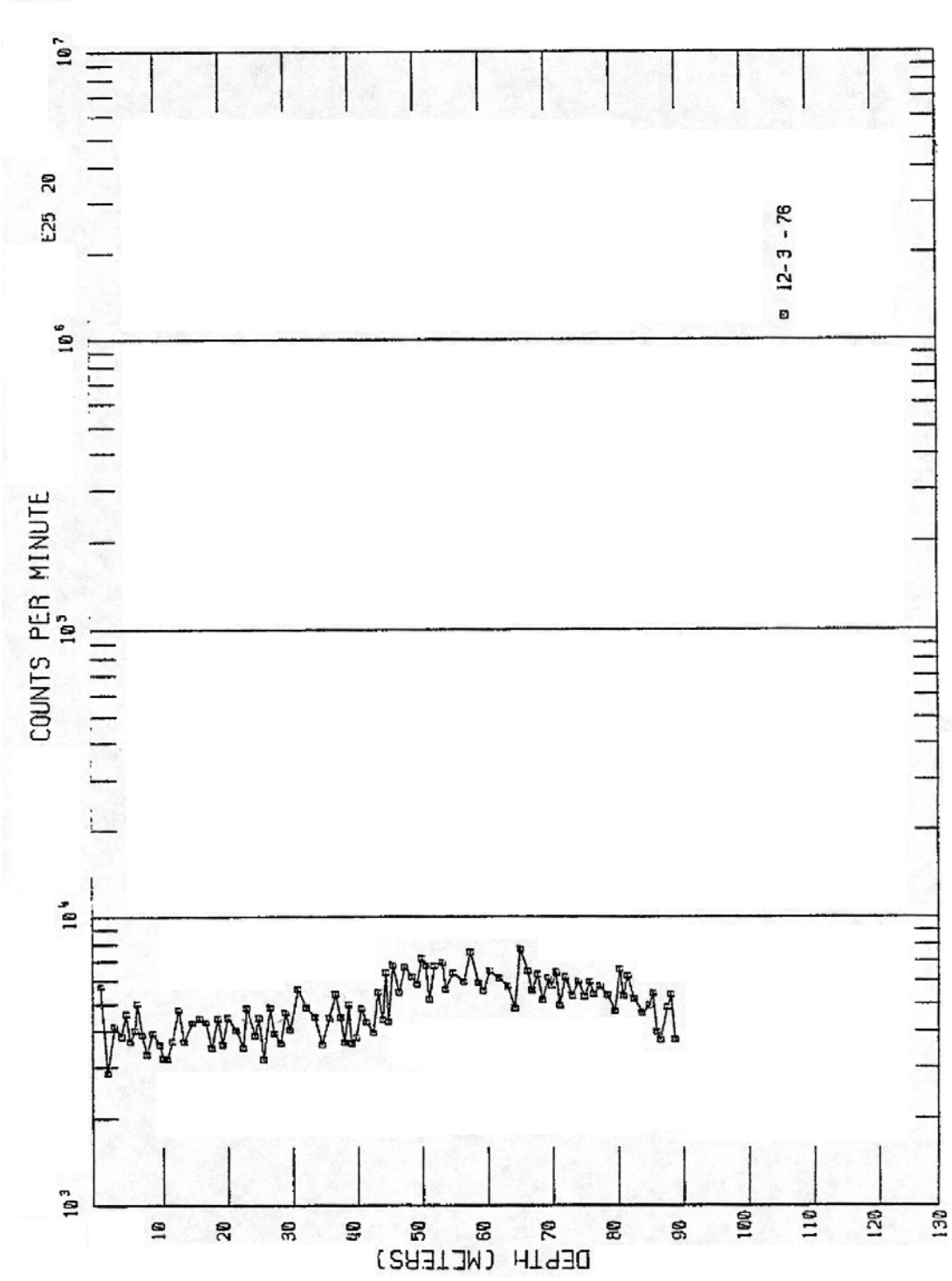
The gross gamma log from Additon et al. (1977) (attached) indicates that the sediments surrounding this borehole contained only background amounts of gamma radiation in 1976.

References:

Additon, M.K., K.R. Fecht, T.L. Jones, and G.V. Last, 1978. *Scintillation Probe Profiles From 200 East Area Crib Monitoring Well*s, RHO-LD-28, Rockwell Hanford Operations, Richland, Washington.

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

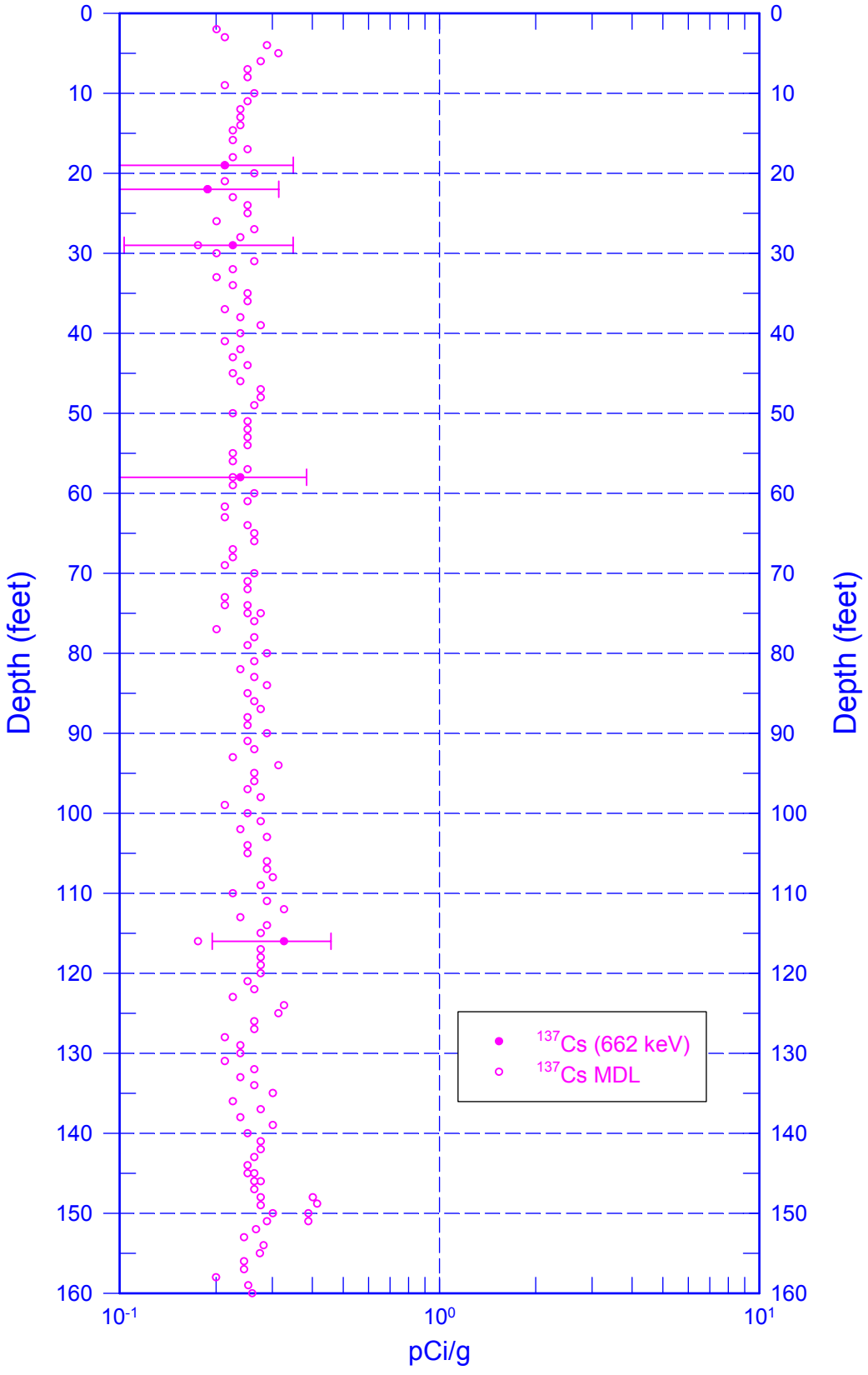
[1] GWL – groundwater level
[2] TOC – top of casing
[3] HWIS – Hanford Well Information System
[4] N/A – not applicable



from Additon et al. (1978)

Scintillation Probe Profile for Borehole 299-E25-20, Logged on 12/3/76

299-E25-20 (A4767)
Man-Made Radionuclides

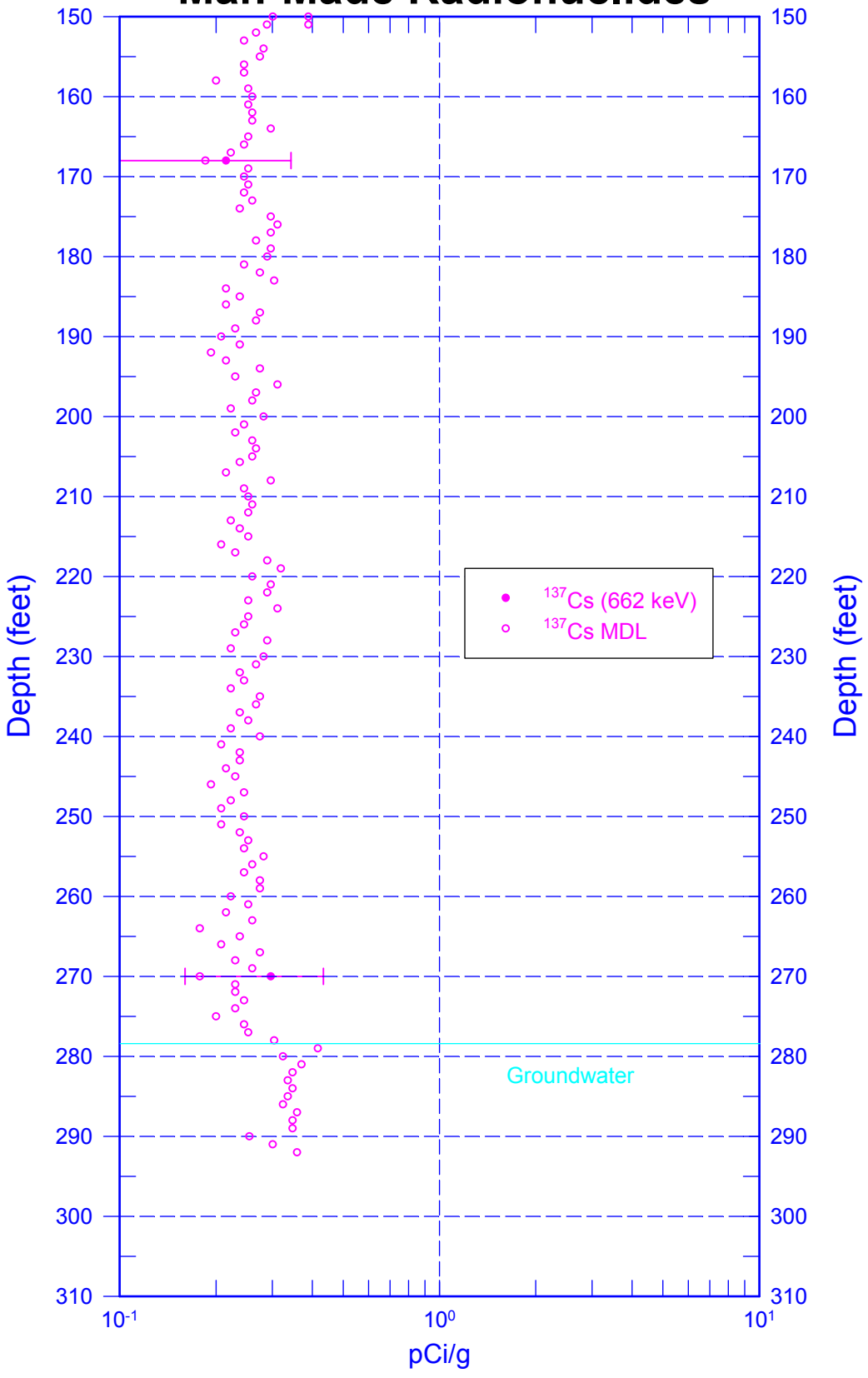


Zero Reference = Top of Casing

Date of Last Logging Run
3/19/2003

299-E25-20 (A4767)

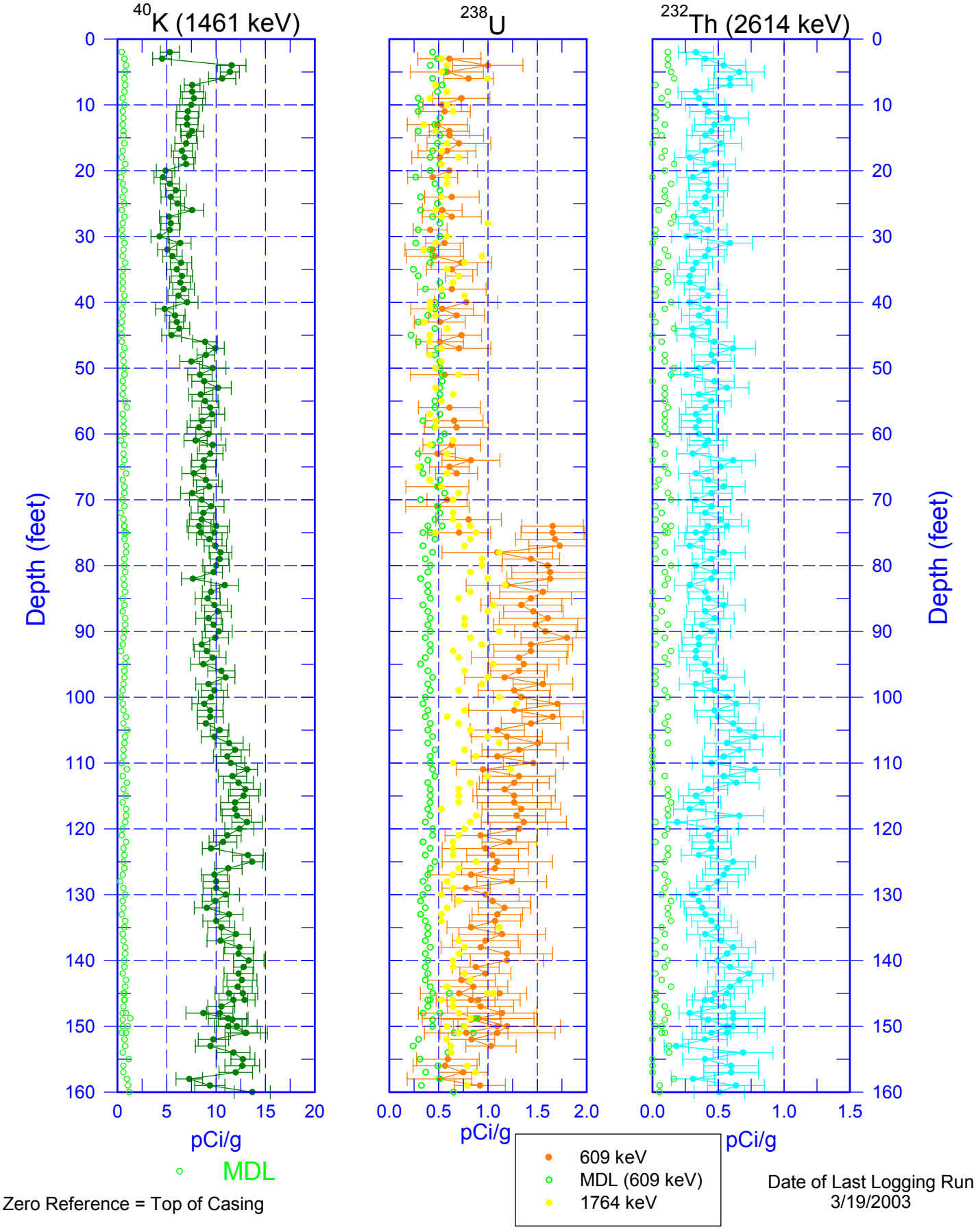
Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run
3/19/2003

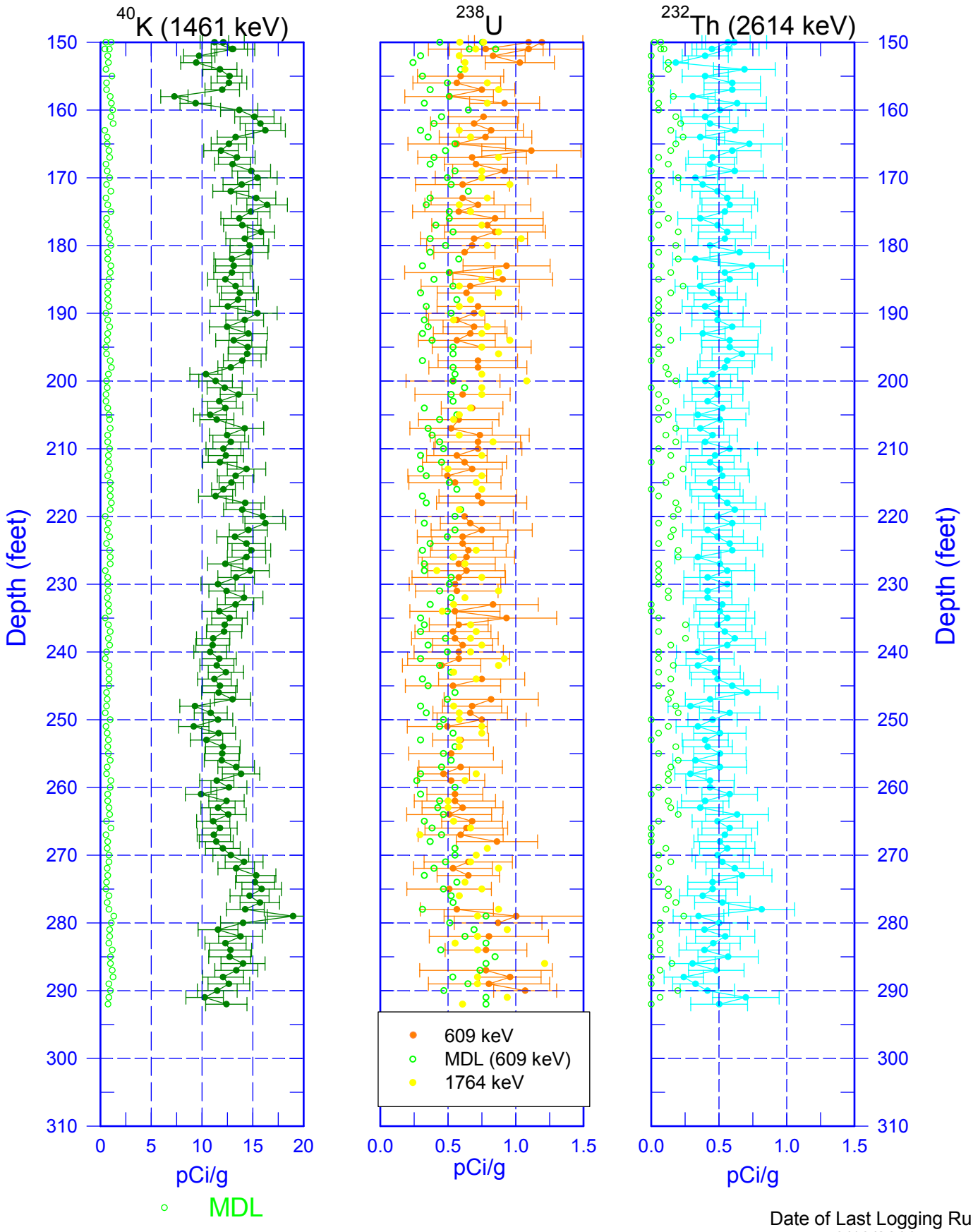
299-E25-20 (A4767)
Natural Gamma Logs



Zero Reference = Top of Casing

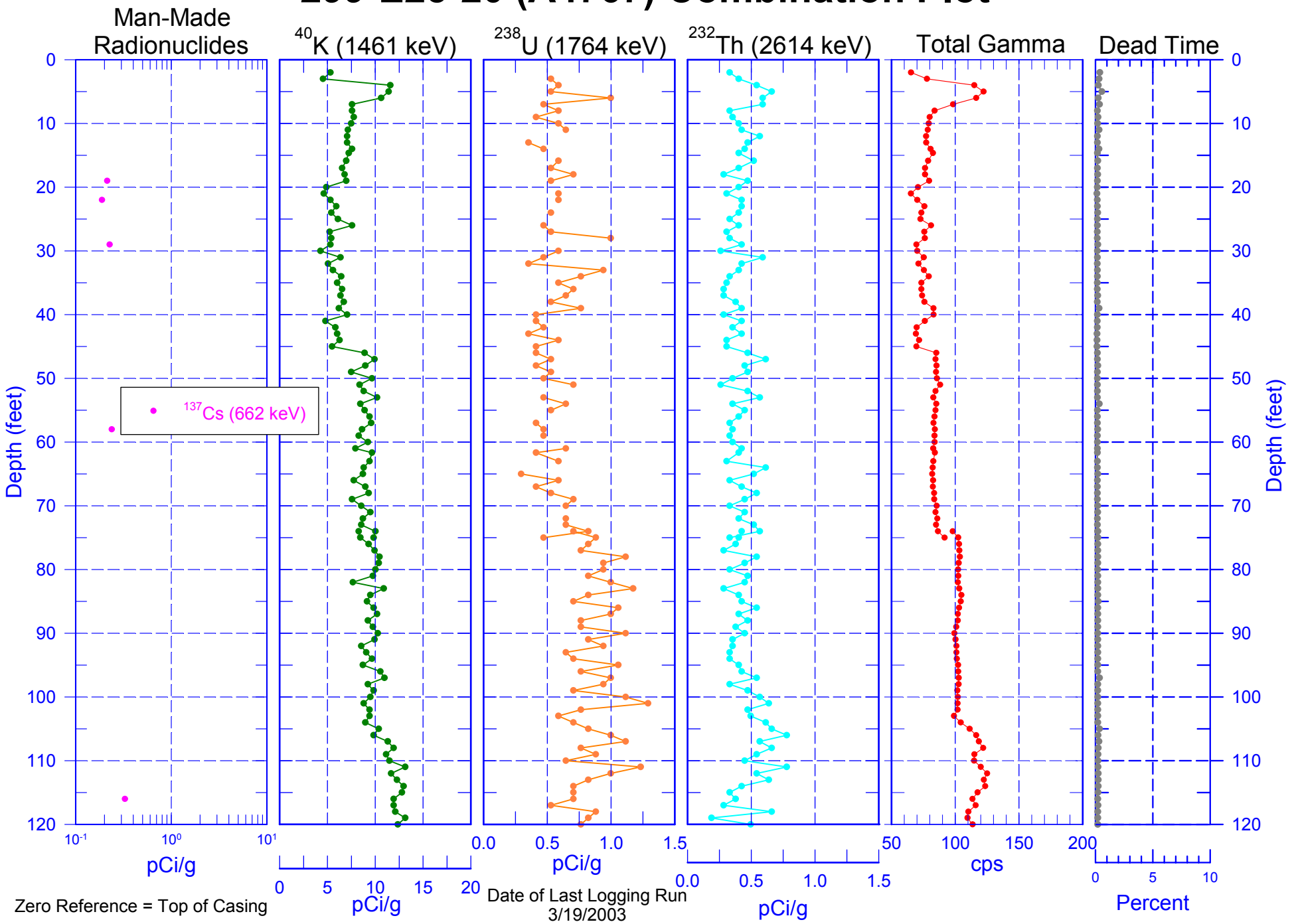
Date of Last Logging Run
3/19/2003

299-E25-20 (A4767)
Natural Gamma Logs

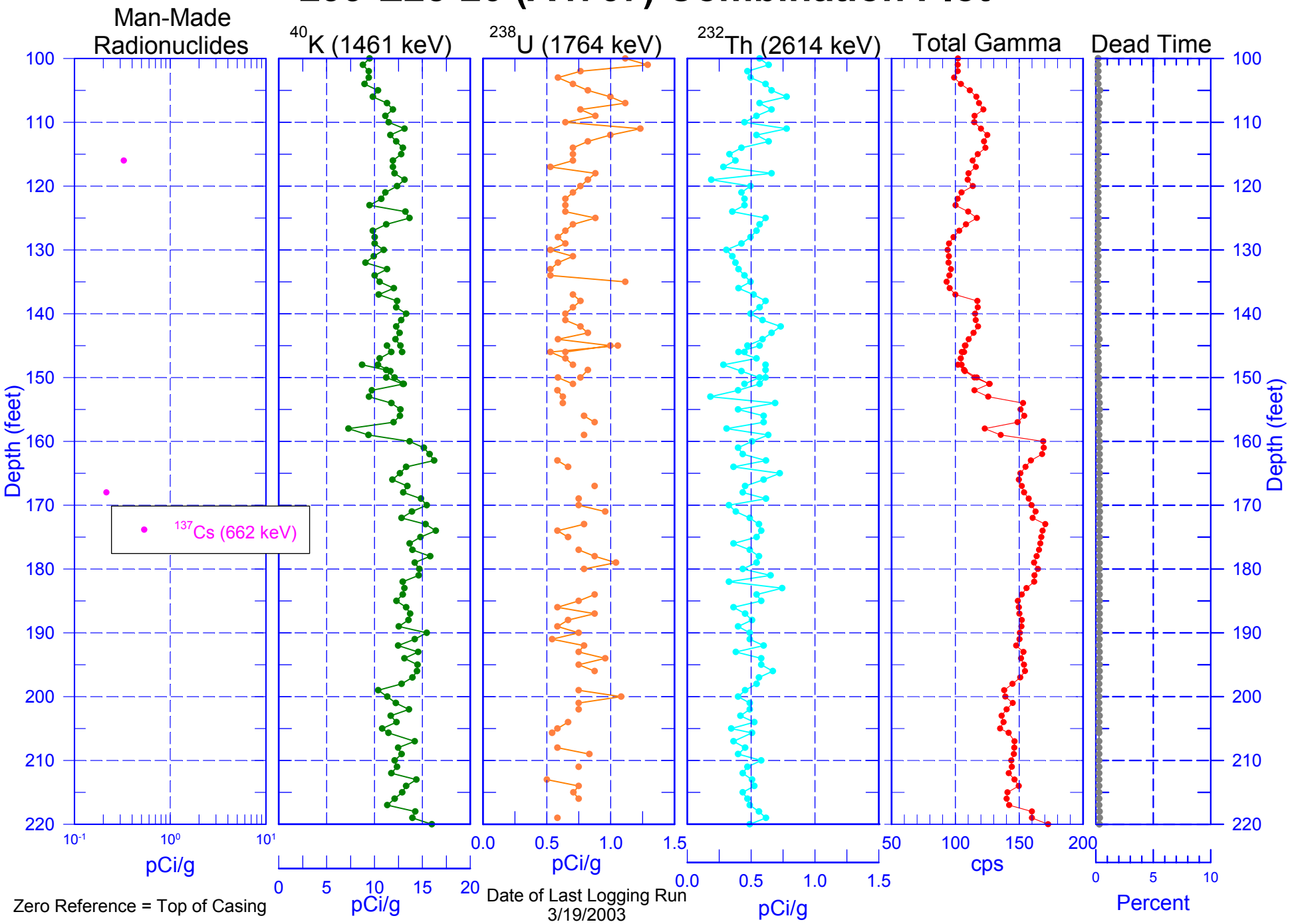


Zero Reference = Top of Casing

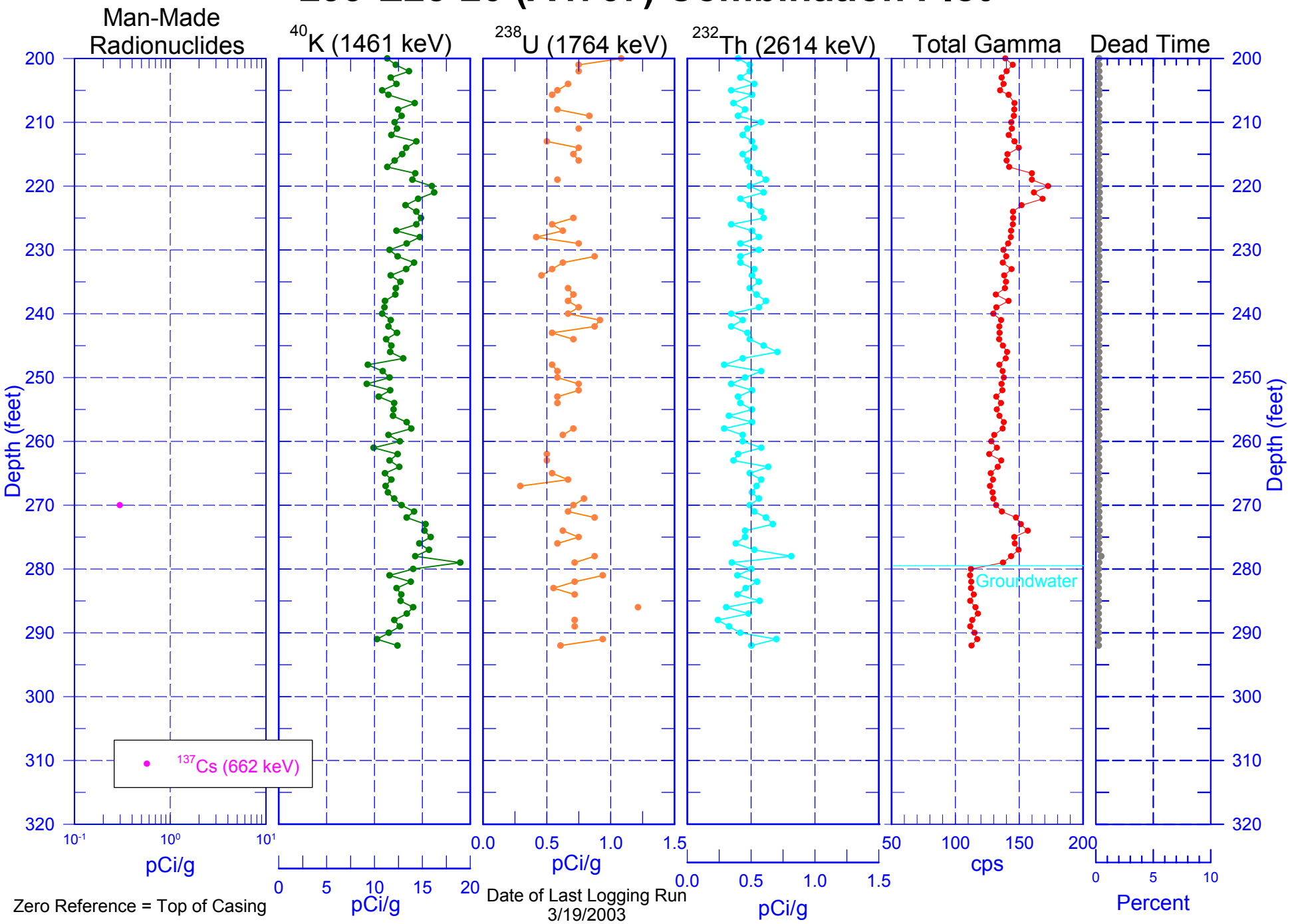
Date of Last Logging Run
3/19/2003


299-E25-20 (A4767) Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Dead Time
137Cs (662 keV)
Depth (feet)
pCi/g
cps
Percent
Zero Reference = Top of Casing
Date of Last Logging Run
3/19/2003

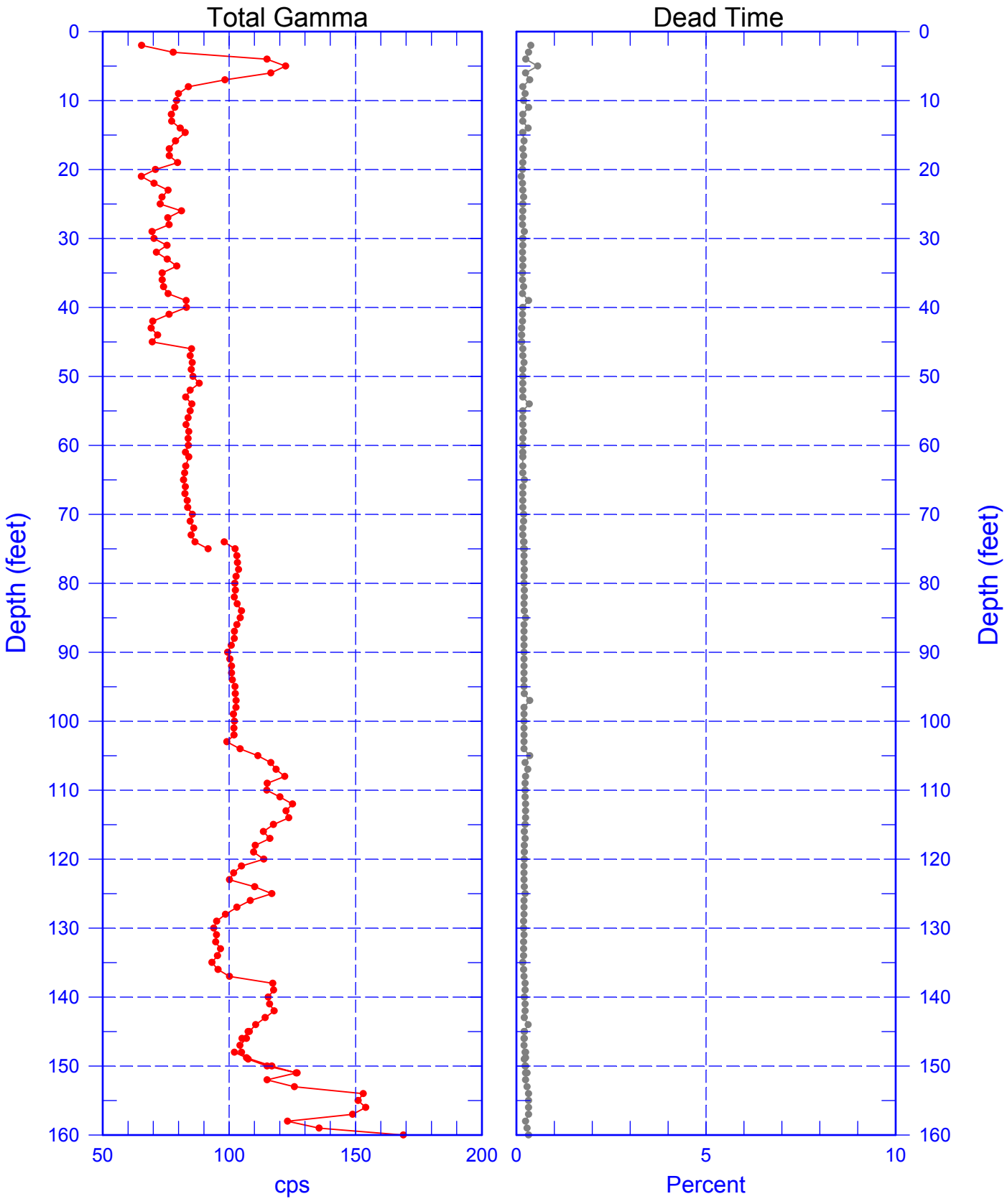
299-E25-20 (A4767) Combination Plot



299-E25-20 (A4767) Combination Plot



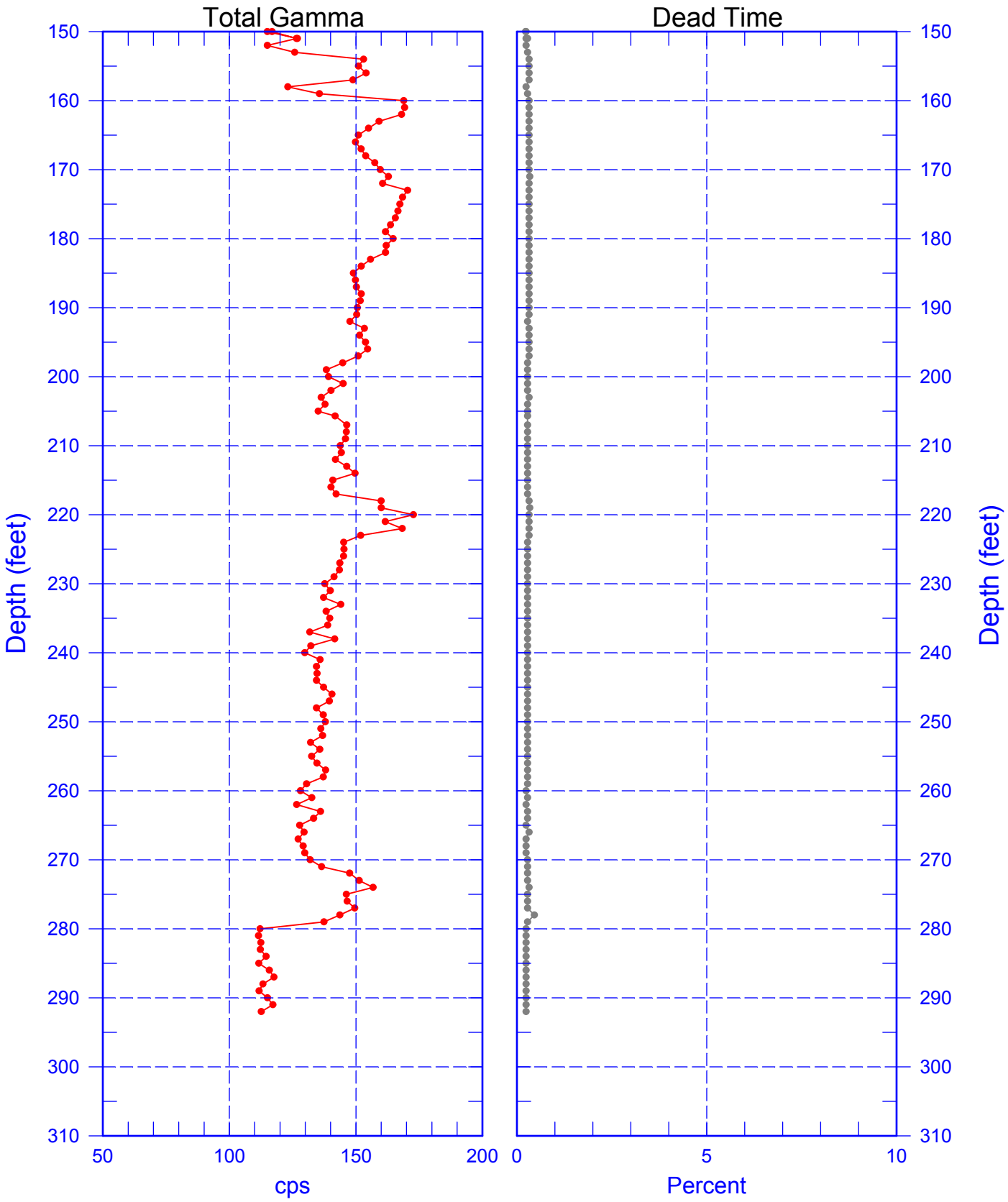
299-E25-20 (A4767)
Total Gamma & Dead Time



Zero Reference = Top of Casing

Date of Last Logging Run
3/19/2003

299-E25-20 (A4767)
Total Gamma & Dead Time



Zero Reference = Top of Casing

Date of Last Logging Run
3/19/2003

299-E25-20 (A4767)

Rerun of Natural Gamma Logs (180.0 to 151.0 ft)